CLAIMS

1. An apparatus for detecting a variation in a probe, comprising:

a probe which is adapted to undergo one or more of a thermoelastic, thermoelectric or thermomagnetic excitation response when excited by temporally varying electromagnetic radiation, the excitation response being a function of the physical and/or chemical properties of the probe and/or of material binding thereto;

a source of electromagnetic radiation;

means for directing the electromagnetic radiation at the probe; and

a transducer adapted to determine the excitation response of the probe.

2. The apparatus of claim 1 in which each probe comprises a probe structure having a substrate surface onto which is bound probe material.

3. The apparatus of claim 2 in which the substrate is preferably a thin film.

4. The apparatus of claim 1 further comprising a plurality of probes.

5. The apparatus of claim 4 in which the plurality of probes are formed in an array.

6. The apparatus of claim 4 or claim 5 in which each probe comprises probe material which is different to that on other probes.

7. The apparatus of claim 2 in which the probe material comprises molecules of one type.

8. The apparatus of claim 2 in which the probe material comprises a mixture of different molecules.

9. The apparatus of claim 1 in which the surface of the probe is planar.

10. The apparatus of claim 1 in which the surface of the probe is curved.

11. The apparatus of claim 1 in which the source of electromagnetic radiation emits radiation in the optical portion of the electromagnetic spectrum.

12. The apparatus of claim 1 or claim 11 in which the source of electromagnetic radiation is a laser.

13. The apparatus of claim 1 in which the source of electromagnetic radiation is positioned so that the radiation impinges directly on the probe material.

14. The apparatus of claim 1 in which the source of electromagnetic radiation is positioned so that it first passes through a substrate transparent to the radiation before impinging on the probe material.

15. A sensor, comprising:

a substrate, and

one or more probes on the surface of the substrate, the probes being adapted to undergo one or more of a thermoelastic, thermoelectric or thermomagnetic excitation response when excited by temporally varying electromagnetic radiation, the excitation response being a function of the

physical and/or chemical properties of the probe(s) and/or material binding thereto.

16. The sensor of claim 15 in the form of a plate.

17. The sensor of claim 15 in which the substrate is electromagnetically transparent.

18. The sensor of claim 15 in which the substrate acts as, or is part of, a transducer.

19. The sensor of claim 15 in which the substrate is of such a thickness that it has sufficient strength for ease of handling, and also that it will permit the desired amount of electromagnetic radiation to pass through it.

20. The sensor of claim 19 in which the substrate has a thickness in the range 0.2 to 1.0 mm.

21. The sensor of claim 15 further including a plurality of probes each of which is adapted to undergo a localised electrical response when the probe is excited by temporally varying electromagnetic radiation and of generating an electrical output response corresponding thereto, the characteristics of the electrical response being a function of the physical or chemical properties of the probe and/or of material binding thereto, and

a transducer for transmitting the electrical response.

22. The sensor of claim 21 in which different probe materials are bound to different probes.

23. A transducer apparatus for detecting spatially localised variations in material binding to the surface of a plate, comprising:

a substrate;

a plurality of thin film probe structures on a surface of the substrate, each probe structure being adapted to undergo one or more of a localised thermoelastic, thermoelectric or thermomagnetic excitation response when excited by temporally varying electromagnetic radiation, characteristics of the excitation response being a function of physical and/or chemical properties of material binding to the surface of the probe structure;

electromagnetic excitation means for directing electromagnetic energy at a selected one of the probe structures in order to elicit the excitation response; and

detection means for determining the excitation response of the probe structures.

24. The apparatus of claim 23 in which the electromagnetic excitation means emits said temporally varying electromagnetic radiation in the optical spectrum.

25. The apparatus of claim 24 in which the substrate is formed from an optically transparent medium, and in which the electromagnetic excitation means is adapted to direct said electromagnetic energy to a lower surface of the probe structure via the substrate.

26. The apparatus of claim 25 in which the probe structures are each adapted to absorb said electromagnetic radiation to thereby generate a thermoelastic excitation response in the form of a volume change within the structure, and in which the detection means comprises means for detecting said volume change in said probe structure.

27. The apparatus of claim 26 in which the probe structures each comprise a thin film metal spot.

28. The apparatus of claim 26 in which the detection means comprises means for receiving reflected electromagnetic energy from the selected probe structure.

29. The apparatus of claim 25 in which the probe structures are each adapted to absorb said electromagnetic radiation to thereby generate a thermoelastic response in the form of a lateral displacement of the structure, and in which the detection means comprises means for detecting said lateral displacement of the probe structure.

30. The apparatus of claim 29 in which the probe structures each comprise a thin film dielectric material spot.

31. The apparatus of claim 23 in which the probe structures include a transducer element for generating an electrical output signal representative of a thermoelastic response of said probe structures.

32. The apparatus of claim 23 in which the probe structures include a transducer element adapted to provide a thermoelectric excitation response to said temporally varying electromagnetic radiation, and in which the detection means comprises means for detecting said thermoelectric excitation response.

33. The apparatus of claim 23 in which the probe structures include a transducer element adapted to provide a thermomagnetic excitation response

to said temporally varying electromagnetic radiation, and in which the detection means comprises means for detecting said thermomagnetic excitation response.

34. The apparatus of any one of claims 23 to 33 in which the electromagnetic excitation means comprises a laser adapted to irradiate selected ones of the probe structures with pulsed or continuous wave electromagnetic radiation.

35. The apparatus of claim 23 in which the detection means comprises an optical interferometer for receiving a reference beam from an optical source, and an interference beam reflected from the probe structure.

36. The apparatus of claim 23 in which the detection means includes a transient recorder or digitising oscilloscope for determining an amplitude and phase variation in thermoelastic response signals received from the probe structures.

37. The apparatus of claim 23 in which the electromagnetic excitation means and the detection means include means for detecting a change in resonant frequency of a selected probe structure.

38. The apparatus of claim 23 in which each probe structure includes an entrant electrode adapted to provide a ground plane to a lower surface of the substrate.

39. The apparatus of claim 23 further including a molecular probe material bound to an exposed surface of the probe structure.

40. The apparatus of claim 23 in which the substrate comprises a disc, and further including:

drive means for rotating said disc relative to an axis;

indexing means for varying the position of said electromagnetic excitation means and said detection means relative to said axis.

41. A sensor plate comprising:

an optically transparent substrate; and

a plurality of thin film probe structures on a surface of the substrate, each probe structure being adapted to undergo one or more of a localised thermoelastic, thermoelectric or thermomagnetic excitation response when excited by temporally varying electromagnetic radiation, characteristics of the excitation response being a function of physical and/or chemical properties of material binding to the surface of the probe structure.

42. The sensor plate of claim 41 further including:

a plurality of different molecular probe materials respectively bound to the exposed surfaces of a plurality of the probe structures.

43. The sensor plate of claim 41 or claim 42 in which the substrate comprises silica.

44. The sensor plate of claim 41 or claim 42 in which the probe structures each comprise a thin film metal spot.

45. The sensor plate of claim 41 or claim 42 in which the probe structures each comprise a thin film dielectric spot.

46. The sensor plate of claim 41 in which each probe structure further includes a transducer element for generating an electrical output signal representative of the thermoelastic response of said probe structure.

47. The sensor plate of claim 41 in which each probe structure comprises a transducer element adapted to provide a thermoelectric excitation response to said temporally varying electromagnetic radiation.

48. The sensor plate of claim 25 further including an electrode for transmitting the thermoelectric excitation response to a detector.

49. A sensor plate comprising:

a substrate;

a plurality of thin film probe structures on a surface of the substrate;

each probe structure comprising a transduction film adapted to undergo one or more of a localised thermoelectric or thermomagnetic excitation response when the probe structure is excited by temporally varying electromagnetic radiation and generating an electrical output response corresponding thereto, characteristics of the electrical output response generated being a function of physical and/or chemical properties of material binding to a surface of the probe structure; and

an electrode for transmitting the electrical output response.

50. The sensor plate of claim 49 further comprising:

a plurality of different molecular probe materials respectively bound to a plurality of said adjacent surfaces on the second face of the substrate.

51. The sensor plate of claim 49 in which the probe structures further include a passivation layer over the transduction film for receiving the respective probe material binding to the surface of the probe structure.

52. The sensor plate of any one of claims 49 to 51 in which the substrate comprises silica.

53. The sensor plate of any one of claims 49 to 51 in which the probe structures comprise a magnetic material.

54. The sensor plate of claim 41 in which the probe structures are arranged in a series of generally circular or helical arrays on a circular disc substrate.

55. A method of using a transducer apparatus according to any one of claims 23 to 40 comprising the steps of:

providing a plurality of probe materials respectively attached to a plurality of probe structures;

exposing the probe structures to a sample material to permit binding of material to the surface of the probe structure;

using the electromagnetic excitation means to direct electromagnetic energy at the probe structures; and

detecting changes in excitation response of each probe structure by comparing its excitation response with and without exposure to the sample material.

56. An acoustic transducer apparatus for detecting spatially localised variations in material binding to the surface of a plate substantially as described herein and with reference to the accompanying drawings.

57. An acoustic sensor plate substantially as described herein and with reference to the accompanying drawings.